

The Northeastern Chukchi Sea: A Complex High-Latitude Ecosystem

S. Wisdom & CSESP Team Chukchi Sea Environmental Studies

(Day, Aerts, Blanchard, Gall, Gallaway, Hannay, Holladay,
Hopcroft, Mathis, Norcross, Questel, Weingartner, Rea,
Macrander, & Eldøy)

Northern Oil & Gas Research Forum

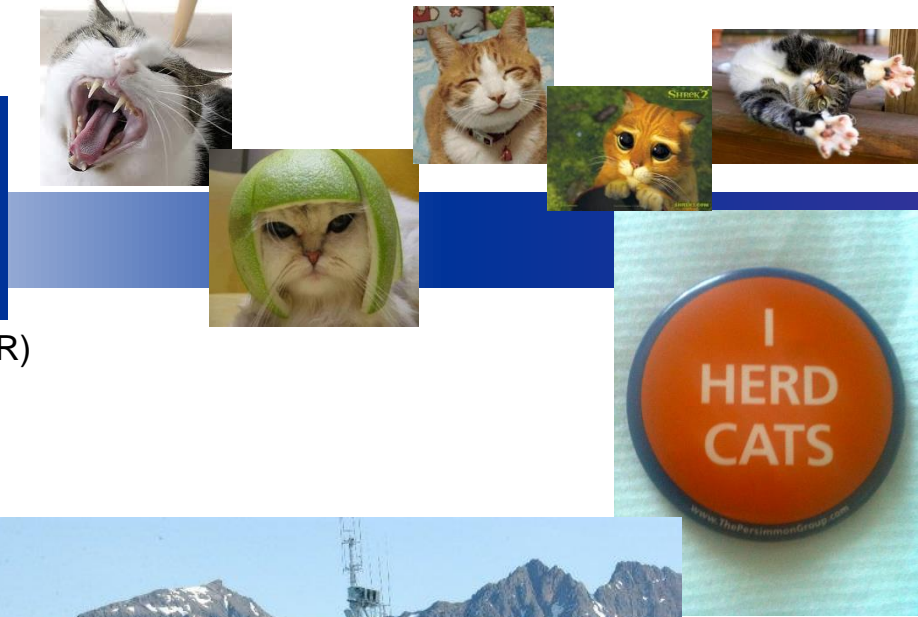
November 13-15, 2012

Anchorage, AK



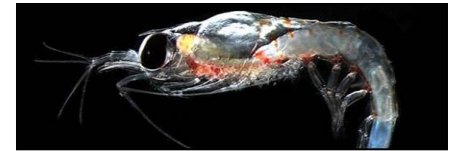
CSESP Team

- ABR Environmental & Research Services (ABR)
- Aldrich Offshore Services (AOS)
- ASL Environmental Services, Inc. (ASL)
- Canyon Creek Consulting
- ERM Consulting
- Fairweather Science LLC
- Inupiat Resources LLC
- JASCO Applied Sciences
- LAMA Ecological
- LGL Alaska Research Associates
- Living Resources LLC
- Natural Resources Consultants (NRC)
- Norseman Maritime Charters, LLC
- Olgoonik Development
- Resource Data Inc. (RDI)
- RPS Evans Hamilton Inc. (EHI)
- SAExploration (SAE)
- SALA Medics
- TigerSoft
- University of Alaska Fairbanks (UAF)
- University of Washington (UW)



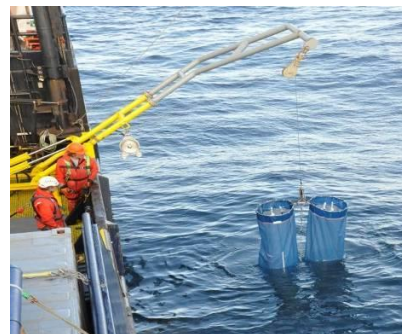
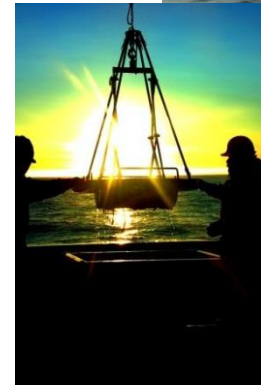
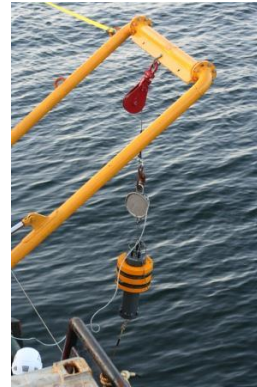
CSESP Overview

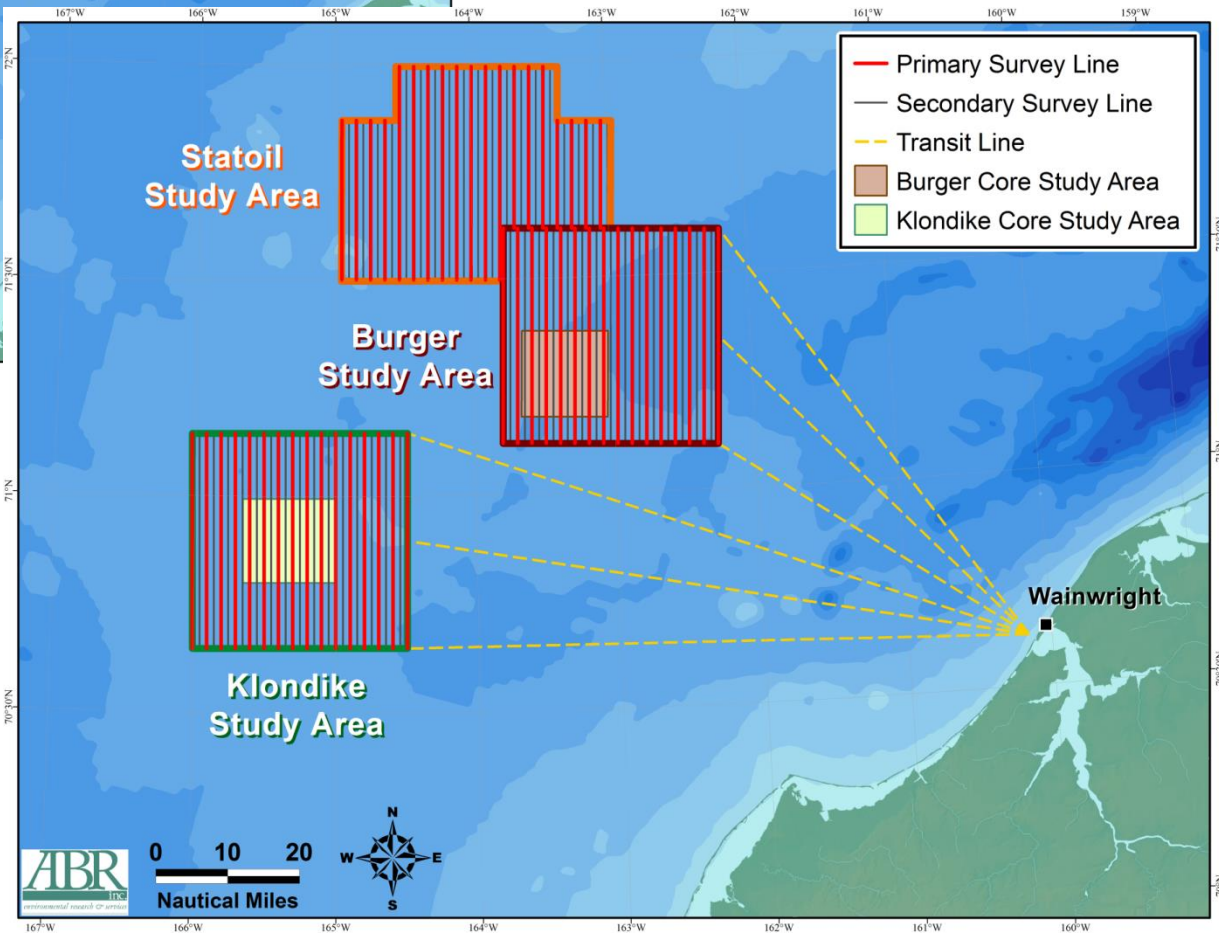
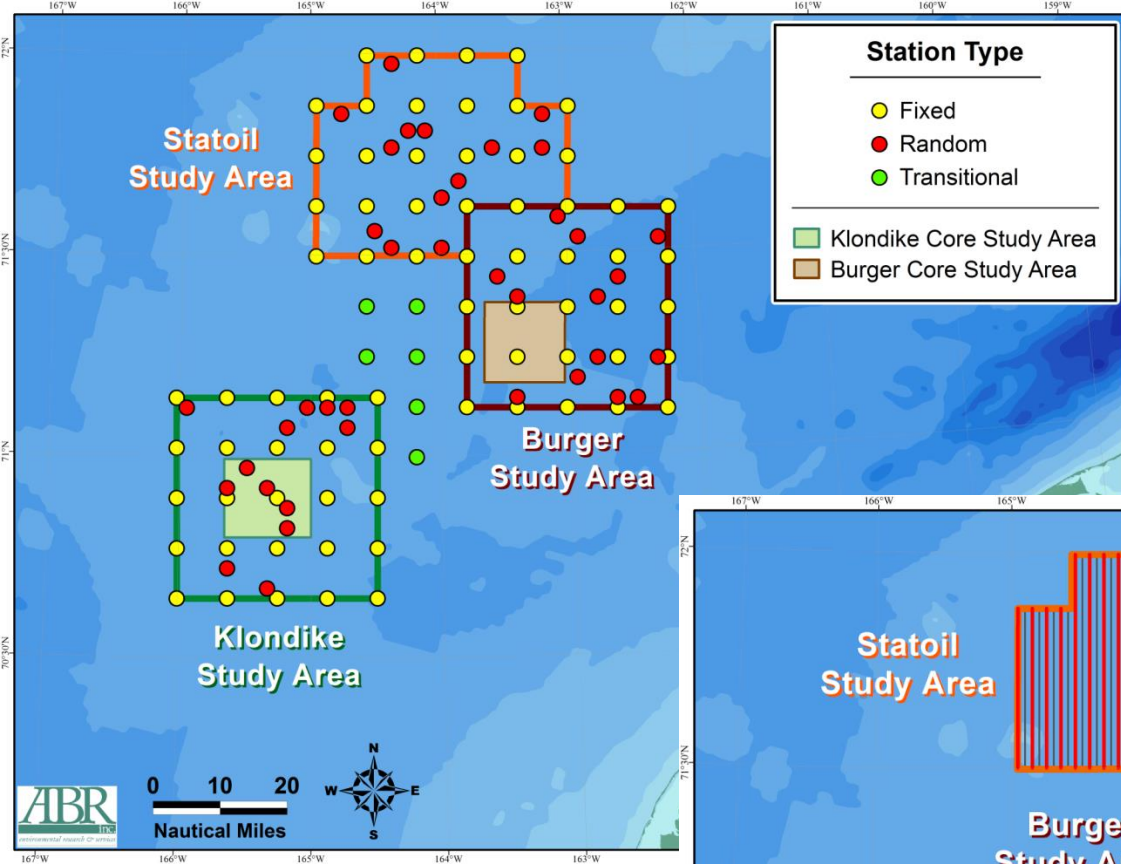
- Multi-year (2008-2012), multi-disciplinary oceanographic study
- Objectives:
 - Collect information to understand environment to support oil & gas exploration permitting
 - Build on historical Arctic scientific data
 - Ecosystem approach to baseline data acquisition & analysis
 - Provide a basis for assessing potential impacts from oil & gas activities



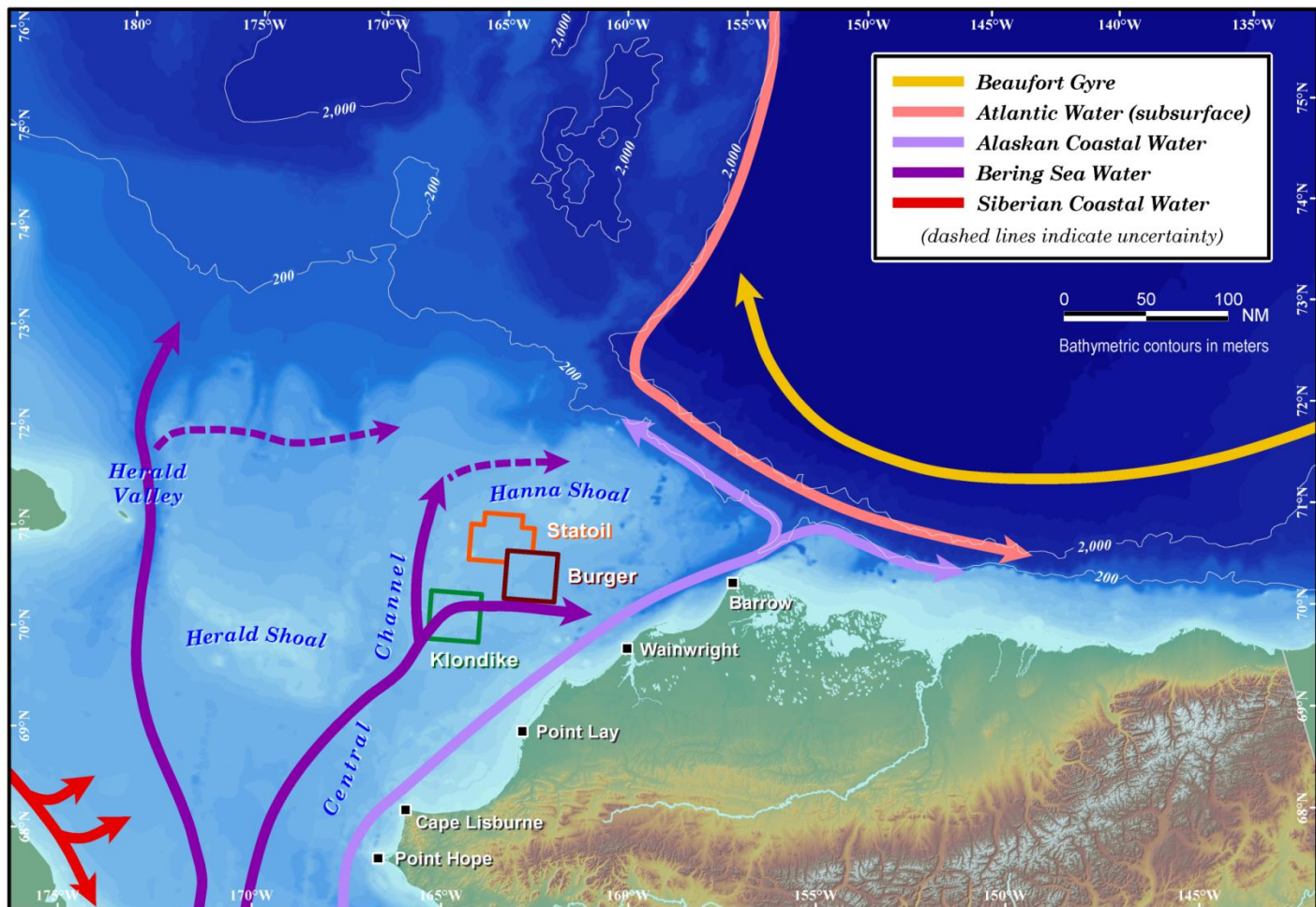
Disciplines

- Oceanographic moorings
- Physical oceanography
- Micro/phytoplankton*
- Nutrients/zooplankton
- Ocean acidification*
- Baseline chemistry*
- Benthic ecology
- Fish ecology*
- Seabird ecology
- Marine mammal ecology
- Passive acoustics





Currents, Bathymetry



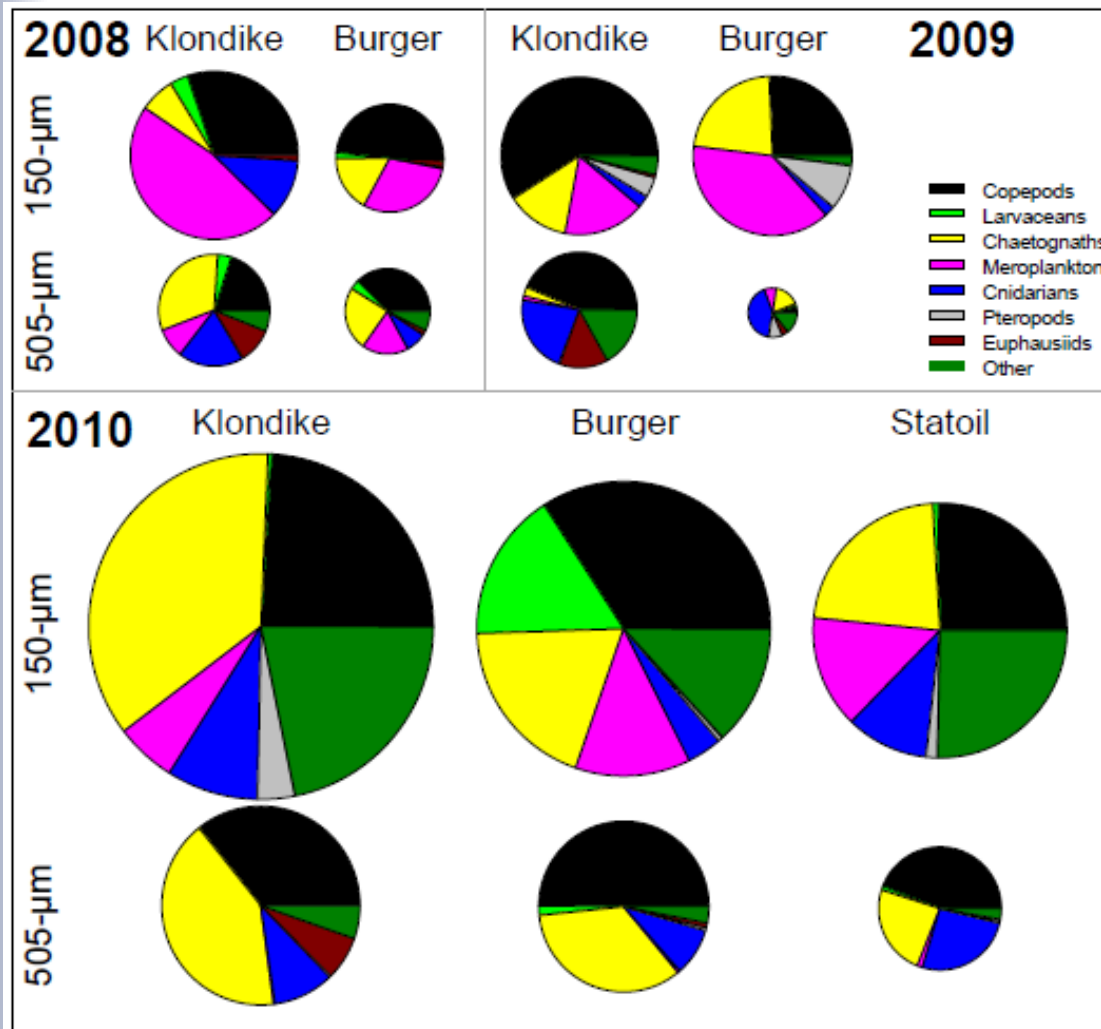
Physical Oceanography

- Water from south of Bering Strait
 - Brings heat, nutrients, plankton, fishes into system
 - Affects production in Chukchi
- Currents, winds affect ice melt-off and movement patterns, timing of blooms
 - Advect warm water from south, melt ice
 - Easterly winds advect ice out of study area
- Two main surface water-masses
 - Bering Sea Water
 - Meltwater

Interannual Variability

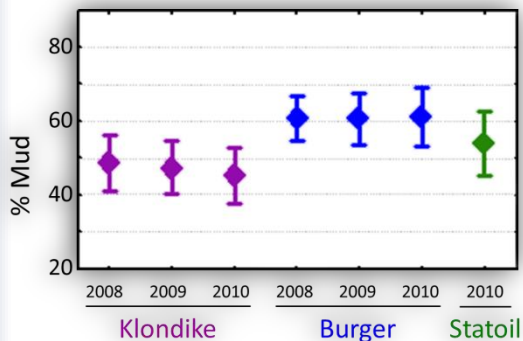
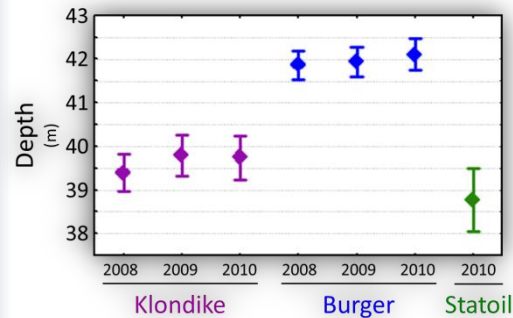
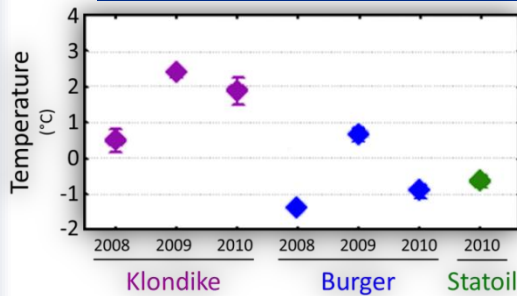
YEAR	CHARACTERISTIC	ICE	BERING SEA WATER	MELTWATER
2008*	Cold	Much, Persistent	Klondike	Burger
2009*	Very Warm (Early)	None	Everywhere	NE Burger
2010	Very Warm (But Later In Year)	Little (Gone Quickly)	Everywhere	NE Burger/ NE Statoil

Zooplankton Ecology



- Klondike highest biomass for larger zoops
- Klondike nearly always highest for smaller zoops
- 2010 >> 2009 > 2008 in terms of biomass & abundance

Benthic Ecology



Klondike ↔ Statoil ↔ Burger



warmer
shallower
sandier

Dynamic
Environment

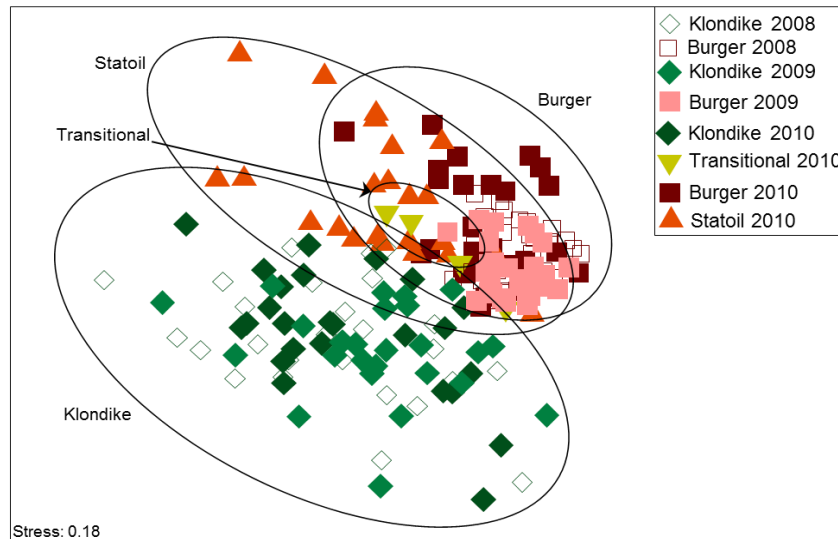


colder
deeper
muddier

Depositional
Environment

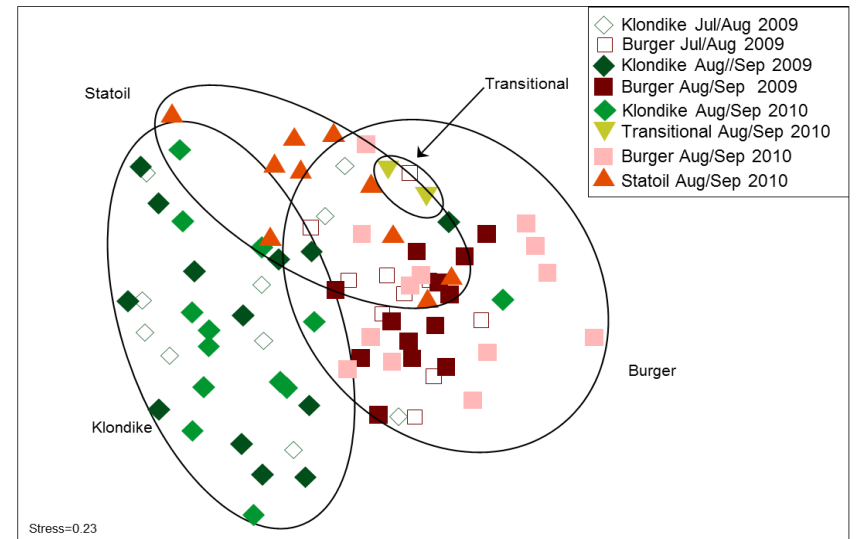
Benthic - MDS

Multi-dimensional scaling: describes and compares overall community structure among samples, areas



Infauna

- Burger & Statoi similar
- Statoi partially overlaps with Burger, little with Klondike
- Klondike has little overlap



Epifauna

- Statoi partially overlaps with Burger, little with Klondike
- Klondike has little overlap with others

Fish Ecology

- Fish communities are benthic-based, invertebrate feeders – few piscivorous fish
- Primarily demersal species (arctic cod, sculpins)
- Few fishes in general, small (25-100 mm)



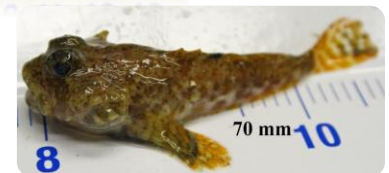
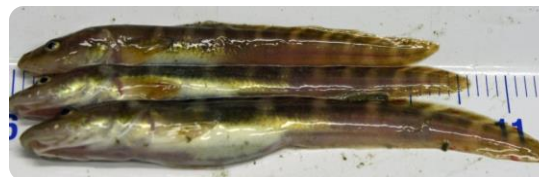
Arctic cod



Stout eelblenny

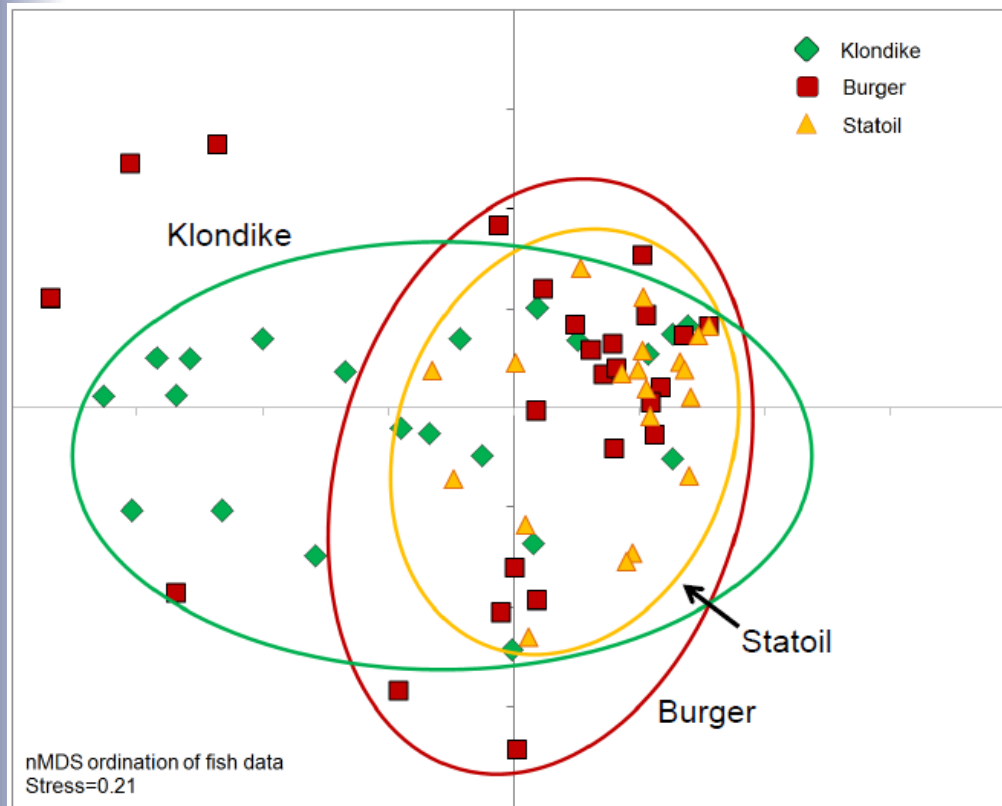


Polar eelpout



Hamecon

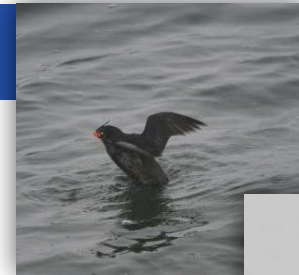
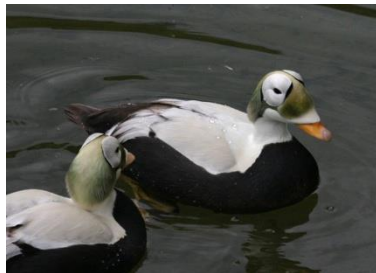
Fish - MDS



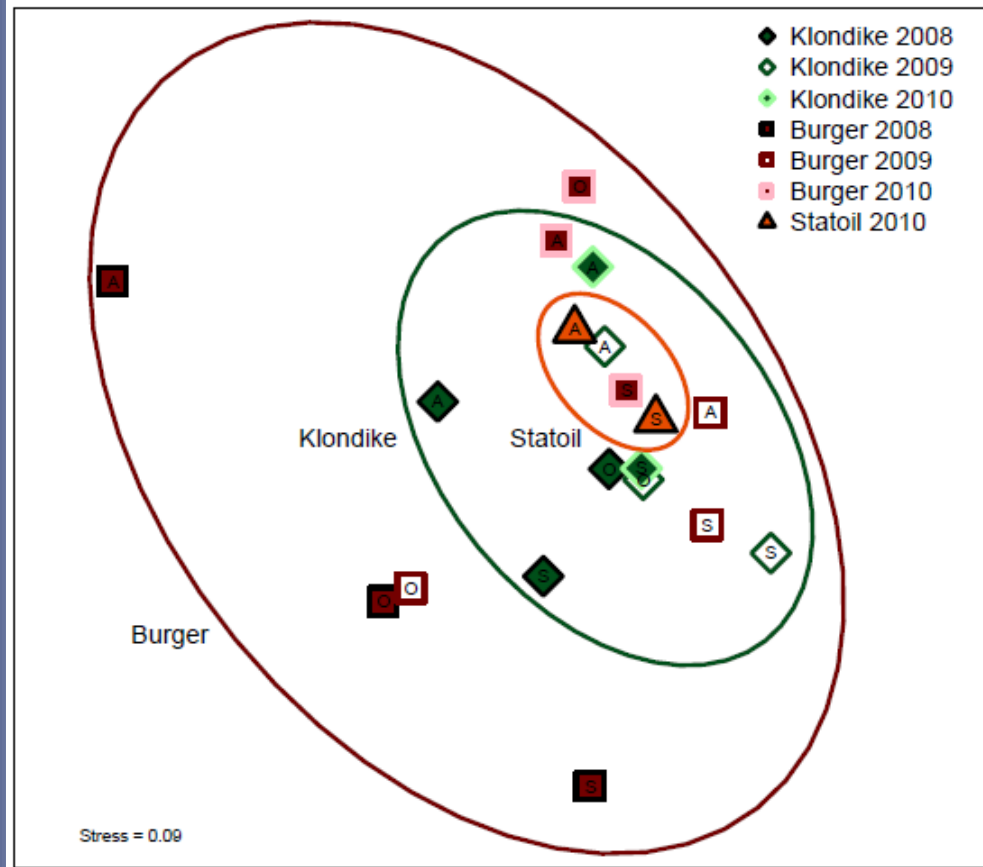
- Burger & Statoil similar overall; some Burger stations very different from all others
- Klondike has only partial overlap with others
- Overall abundance and diversity is higher in Klondike

Seabird Ecology

- Primarily ~8-10 species (diving-feeders, surface-feeders)
- Dominated by zooplankton-feeders (auklets, shearwaters)
- Few fish-feeders (murre)
- Generally higher densities in Klondike than Burger, Statoil



Seabirds - MDS



- Klondike consistent among years
- Burger very different from Klondike in 2008
- All areas had similar communities in 2009-2010

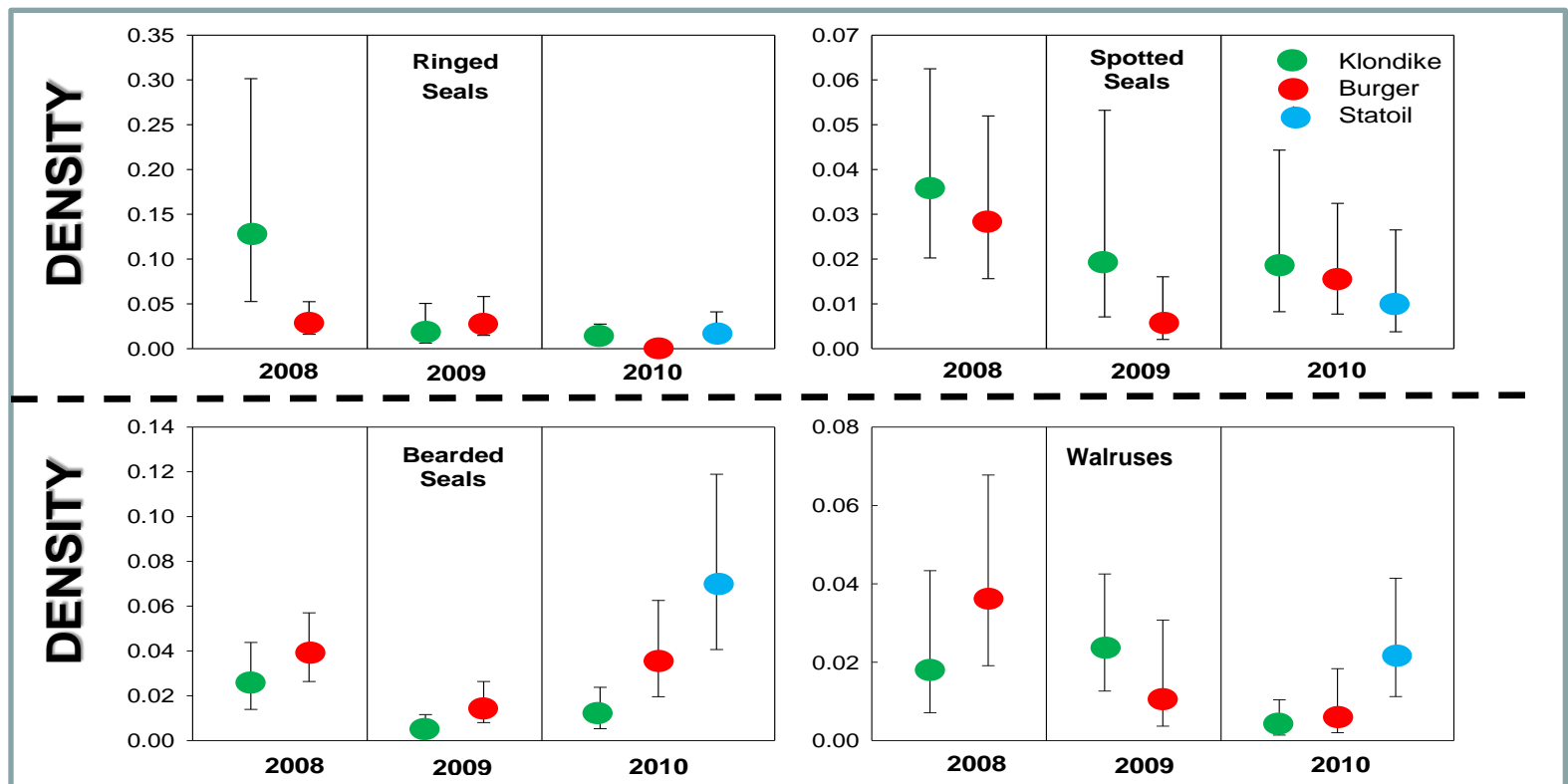
Marine Mammal Ecology

- Bowhead whales most common in Sept/Oct in all years in Burger
- Beluga whales only acoustically detected in all years
- Gray whales observed in all years
- Minke whales, killer whales, and harbor porpoises low but increasing numbers each year
- Dominated during open water season by seals and walruses
 - Pelagic feeders (ringed, ribbon, spotted seals)
 - Benthic feeders (bearded seals, walruses)



Seal Density

- Pelagic feeders mostly in Klondike
- Benthic feeders mostly in Burger & Statoil

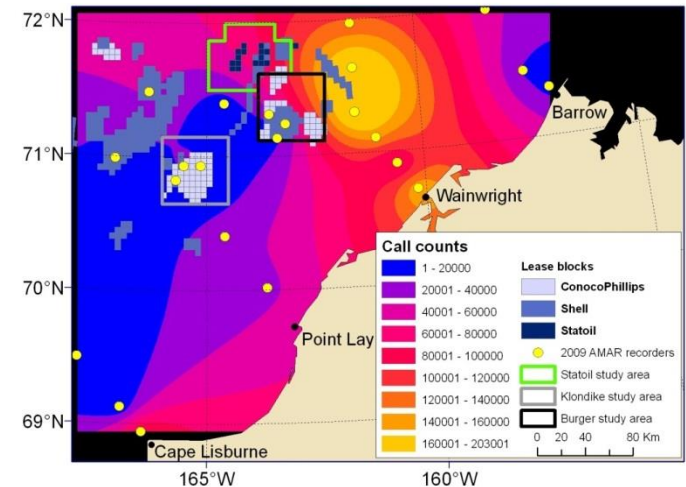


Passive Acoustics – Walruses

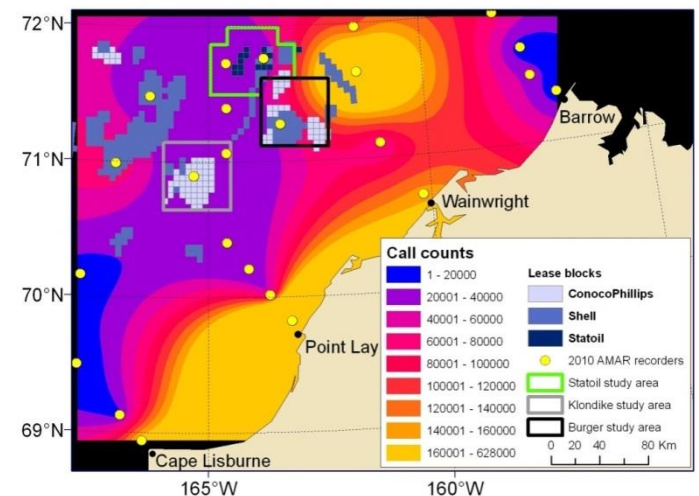
- Walrus detections year-round
- Increase from Jul to mid-Aug
- Highest north of Wainwright toward Hanna Shoal
- 2009 and 2010 on-shore haul-outs



2009



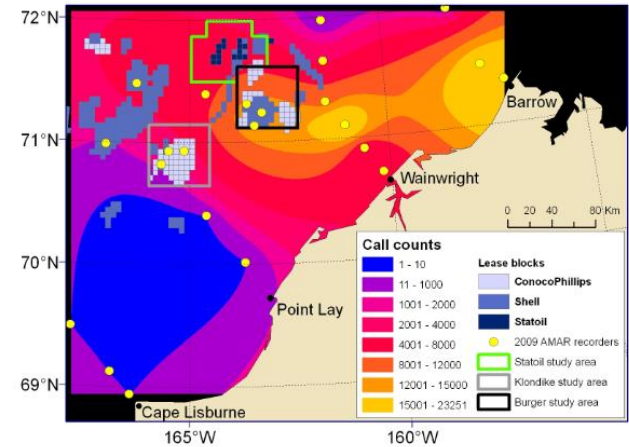
2010



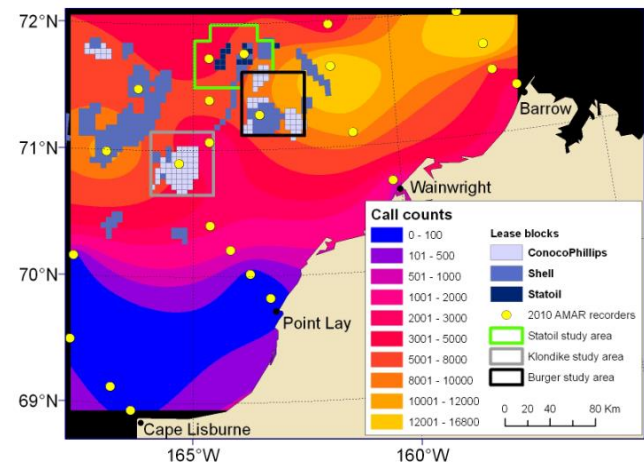
Passive Acoustics – Bowheads

- Pulses of detections ~Sept 20-30 increase to mid-Oct and later
- Call types evolve from moans to complex calls and songs from mid-Oct to late Dec
- Satellite tags indicate migration near 73° N (shelf break); recorders near break in 2011 for first time

2009



2010



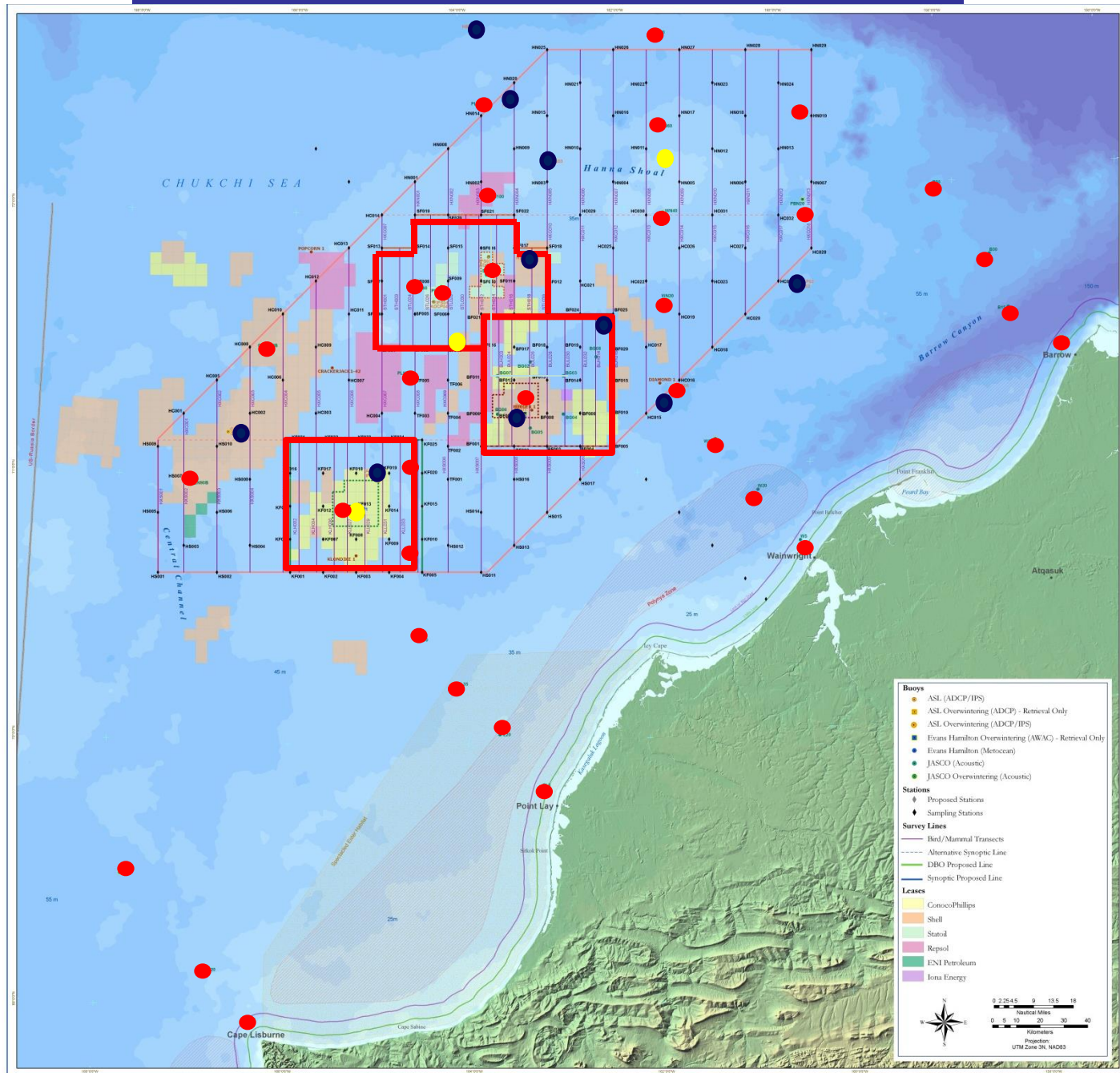
CSESP Summary

- Ecosystem Attributes
 - NE Chukchi not homogeneous & ***highly variable*** spatially (small scales), seasonally, interannually
 - Sea ice retreat varies
 - ✓ Affects magnitude & timing of spring bloom
 - ✓ Affects tightness of benthic-pelagic coupling
 - Water temperatures varies
 - ✓ Affects zooplankton via growth & reproductive rates
 - ✓ Influences distribution of higher trophic levels
 - Few large fish collected
 - Few fish in Burger, Statoil

CSESP Summary

- Klondike – pelagic system
 - Flow-through system
 - Most nutrients already stripped out farther south, so not as productive as it could be
 - More pelagic-feeding seabirds & seals
- Burger – benthic system
 - Most carbon flowing to benthos
 - Benthic communities have higher biomass & abundance
 - More benthic-feeding pinnipeds & whales
- Statoil – similar to Burger (W similar to Klondike)
 - Western end catches edge of Central Channel Flow like Klondike
 - Central/eastern section like Burger

2011 & 2012



CSESP Next Steps

- Analysis of regional study area 2011 & 2012
 - 2011 Final reports out soon
- Finalization of *Continental Shelf Research* synthesis publications
 - 3 of 10 final, anticipated release Feb 2013
- Planning for 2013
- www.chukchiscience.com

QUESTIONS?

www.chukchiscience.com

